

*REMARKS*

Applicants have reviewed the Office Action dated October 24, 2011, and the references cited therein. Claims 1-22 were previously pending. Claims 17-22 were previously withdrawn. Claims 1-16 were rejected under 35 U.S.C. §103(a) as obvious over So et al., US App. Pub. 2005/0036667 (So) in view of Silber, US App. Pub. 2002/0181762 (Silber).

Applicants have amended claim 1 in response to the Office Action by incorporating the recited elements of claim 9 (now canceled). Claim 16 is not substantively amended, as that claim was previously distinguished from previously pending claim 1 by the presence of a two types of light providing: (1) an image of a buried structure within an object, and (2) a visual image of the object.

Applicants note that applications including claims of similar scope are now allowed in both the European and Japanese Patent Offices.

Applicants traverse the rejection of previously pending claims 1-16 and request favorable reconsideration of the Office Action's grounds for rejecting the previously pending claims in view of Applicants' Amendments and Remarks provided herein below.

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*Applicants' Specific Response to the Obviousness Rejection of Claims 1-16*

Applicants traverse the rejection of independent claims 1, 14 and 17 as being obvious over So in view of Silber in view of Applicants' amendment to claim 1 (incorporating elements previously recited in canceled dependent claim 9). In particular, the Office Action does not establish a *prima facie* case of obviousness with regard to each of the presently pending independent claims since the cited references do not describe Applicants' claimed edge analysis is performed on two distinct images rendered from first and second light types. The differences in the detected edges are subsequently used to identify a buried structure image from an object.

Particular points regarding Applicants' traversal of the current obviousness rejection of claims 1, 14 and 16, are discussed in detail herein below.

*a. Applicants' claimed invention*

The elements of claim 9 (reproduced below), now incorporated into claim 1, highlight the distinctions between Applicants' claimed invention (also embodied in independent claims 14 and 16) and the prior art. Currently pending claim 1 now recites:

“aligning said bounded infrared light source with a visual light source;  
providing a first edge analysis of an infrared light source image;  
providing a second edge analysis of a visual light source image;  
comparing a first set of edges detected during said first edge analysis  
with a second set of edges detected during the second edge analysis; and  
discarding, based on the comparing the first set and second set of  
images, edges detected in the infrared light source image that are also detected  
in the visual light source image.”

Each of the presently pending independent claims recites elements directed to performing edge (e.g., gradient) analysis based upon images arising from irradiation of an object by two distinct light types. Moreover, as recited in claim 1, the compared edge analyses are based upon two very different types of light wavelengths – visual light and infrared light.

The visible light image contains contrast information at an object's surface. The infrared light image contains, when compared to the visible light image, substantially more contrast information from image artifacts located below a surface of the object. Thus, the claimed invention is based, indirectly, upon image contrast information originating from differing ranges of depths of the imaged object.

The claimed invention furthermore recites elements directed to two distinct images (generated from different imaging light) that are aligned. Thus, resulting contrast arising from shadows, surface texture, body hair, etc. are pixel-to-pixel matched for each of the two differing light source-type images. Thus, it is possible to selectively enhance contrast information hidden to the human eye (i.e., below the object surface), while leaving superficial contrast (e.g., shadows, non-flat surface tissue structures, body hair, etc.) unchanged. The claimed invention, incorporated into each of the independent claims, are based upon the principal of injecting, by a bounded light source, (primarily) infrared light into an object (e.g.,

tissue) and imaging buried structures, by performing image artifact subtraction using an image edge analysis rendered from an image created from visible light.

The above-discussed aspects of the claimed invention are neither described nor suggested in any way by the combined teachings of So and Silber.

*b. Cited Prior Art*

**So**, upon which the Office Action primarily relies, describes two photon luminescence photography that relies upon injecting luminescent material in a tissue (i.e., dihydrorhodamine cleaved by reactive oxygen into individual fluorescent rhodamine molecules) and then irradiating the tissue with laser light with a specific wavelength which would be properly characterized as a “bounded” light source as recited in the claims. See, So, paragraph [0052]. However, So explicitly relies upon luminescence and captures only luminescent light in a 3-dimensional (volumetric) scan. *The induced fluorescence is collected by the same objective through which the irradiating light is emitted*, and an additional barrier removes residual scattered light. See, So, paragraph [0055].

So’s imaging mode (based on fluorescent light induced in the imaged object) thus differs from the claimed invention which relies upon image information (edges/gradients) generated from scattered infrared light to image embedded structures under a tissue surface.

**Silber**, upon which the Office Action relies to fill gaps in So’s disclosure, describes obtaining an object image with a large focal depth from a plurality of images of the same object acquired at different distances, locations and focus settings. Each individual image has a limited focal depth, and Silber describes combining the multiple images of limited focal depth to render an image with a large focal range.

Notably absent in Silber is any teaching relating to comparing edges detected in images provided from two types of light.

*c. Applicants’ claimed invention is not rendered obvious by So and Silber*

Applicants traverse the rejection of each of the **independent claims** as obvious over So and Silber. As noted previously herein above, Applicants’ claimed invention recites obtaining an image of a buried structure in an object based upon edge/gradient analysis performed upon images created from irradiating the object with two distinct types of light (with one being visual light and the other being capable of imaging structures buried below

an imaged surface). In So, the image is created solely by fluoresced light emitted by irradiated structures within a cell (backscattered light is filtered out). Silber does not combine image information obtained from *different light types* – instead relying on taking several images using a same light source at various focal depths to render an image having a range of focal depths.

The claimed technique for imaging a buried structure within an object by performing edge/gradient analysis upon, and then comparing edges identified within, two images rendered from two distinct light types, is not described by the combined teachings of So and Silber that use only a single light type to render an image. In particular, while Silber relates to image enhancement techniques and removing artifacts, the way in which such functionality is carried out differs substantially from Applicants' claimed invention that renders an image of a buried structure in an object by:

- (1) creating two distinct images using two distinct light types that provide different image information for a same imaged object; and
- (2) comparing edge analysis information rendered from the two distinct images.

The differences between the edge analysis information rendered from two images arise from the differences in the range of depth within the imaged object as opposed to the focal length at which information is acquired (Silber).


One skilled in the art would not have any reason to modify So, in view of Silber, to render the claimed invention. For one, Silber does not even describe the necessary modifications (noted above). Moreover, Silber *could* be applied to So to possibly improve removal of artifacts from an image created by So's fluorescence image. However, such modification still does not describe the way in which the claimed invention obtains an image of buried structure in an object by discarding edges detected in the (infrared) image containing an image of a buried structure if such edges are also detected in the visual image.

Moreover, Applicants traverse the rejections of the remaining dependent claims (claim 9 being addressed in the discussion of the rejection of currently amended claim 1). Applicants submit that each of these claims is patentable for at least the reasons set forth herein above regarding the non-obviousness of independent claims 1 and 14 from which the presently pending dependent claims depend.

*Conclusion*

Applicants respectfully submit that the patent application is in condition for allowance. If, in the opinion of the Examiner, a telephone conference would expedite the prosecution of the subject application, the Examiner is invited to call the undersigned attorney.

Respectfully submitted,



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